Soils and climate change: user needs for mitigation and adaptation

Pete Smith, Institute of Biological and Environmental Sciences, University of Aberdeen, 23 St Machar Drive, Aberdeen, AB24 3UU, UK

Intergovernmental Panel on Climate Change (IPCC) Tier 1 methodologies commonly underpin project-scale carbon accounting for changes in land use and management, and are used in frameworks for Life Cycle Assessment and carbon footprinting of food and energy crops. These methodologies were intended for use at large spatial scales. This can introduce error in predictions at finer spatial scales. There is an urgent need for development and implementation of higher tier methodologies that can be applied at fine spatial scales (e.g. farm/project/plantation) for food and bioenergy crop GHG accounting to facilitate decision making in the land-based sectors.

Higher tier methods have been defined by IPCC and must be well evaluated and operate across a range of domains (e.g. climate region, soil type, crop type, topography), and must account for land use transitions and management changes being implemented. Furthermore, the data required to calibrate and drive the models used at higher tiers need to be available and applicable at fine spatial resolution, covering the meteorological, soil, cropping system and management domains, with quantified uncertainties. Testing the reliability of the models will require data either from sites with repeated measurements, or from chronosequences.

Here I present current global capability for estimating changes in soil carbon at fine spatial scales, and present a vision for a framework capable of quantifying land use change and management impacts on soil carbon, which could be used for addressing issues such as bioenergy and biofuel sustainability, food security, forest protection, and direct/indirect impacts of land use change. The aim of this framework is to provide a globally-accepted standard of carbon measurement, data infrastructure and modelling appropriate for GHG accounting that could be applied at project to national scales (allowing outputs to be scaled up to a country level), to address the impacts of land use and land management change on soil carbon for climate mitigation and adaptation.